Salisbury University Department of Mathematical Sciences

MATH 471/571 : Numerical Methods
Syllabus (Tentative)

Description: Interpolation, functional approximation, numerical differentiation and integration, nonlinear equations, numerical solutions of differential equations, analysis of error. 4 Hours Credit: Meets four hours per week.

Prerequisites: C or better in COSC 117 or COSC 118 or COSC 120 and one of the following: MATH 306 or MATH 310 or PHYS 309.

Intended Audience: This is an ideal course for those who wish to solve real-world problems through computational mathematics techniques, iterative and recursive solvers, and learn about various errors which may contaminate computational/numerical results.

Objective: To introduce computational mathematics and basic numerical analysis. To introduce various techniques to solve problems in mathematics, computer science, engineering, and physical science. To gain proficiency in the use of Python and several Python Libraries, including (but not limited to): Numpy, Matplotlib, and Pandas.

Textbooks: *An Introduction to Numerical Methods and Analysis*, 3rd edition by James F. Epperson; Wiley. ISBN: 9781119604693. There will also be extensive class notes.

Topic	Weeks
Mathematical Preliminaries and Error Analysis	3
Overview of Python and review of Calculus (limits, continuity, differentiability, Riemann integral, Taylor Series), floating-point arithmetic, errors in scientific computation, and a brief survey of modern computational mathematics.	
Survey of simple methods and tools	2
Numerical Differentiation, Nested Multiplication, Euler's method and Linear interpolation	
Solutions of Equations of One Variable	2
The Bisection method, Newton's method, Secant Method, and Fixed-Point solutions. Application: Root-finding problems.	
Interpolation and Approximation	2
Lagrange polynomials, divided differences, Hermite interpolation, splines.	
Numerical Integration	2
Simpson's, Trapezoidal and Midpoint Rules, Gaussian quadrature,	
Numerical Solution of Initial-Value Problems	2
Euler's methods, Runge-Kutta methods, Multistep methods, stability.	
Tests and Review	1
Total	**14**

Evaluation

Projects and Presentations	25 – 30%
Tests	45 – 55%
Final Examination	20 – 25%

- Graduate students will be assigned special homework/test problems or projects.
- Clear descriptions of thought processes, evidence of critical thinking, and effective communication must be demonstrated in written work.

- **Writing Across the Curriculum:** Students will be expected to communicate mathematics and mathematical ideas effectively in speech and writing. At the University Writing Center, trained consultants are ready to help you at any stage of the writing process. In addition to the important writing instruction that occurs in the classroom and during professors' office hours, the Center offers another site for learning about writing. **All students are encouraged to make use of these important services.**
- **NOTE:** Once a student has received credit, including transfer credit, for a course, credit may not be received for any course with material that is equivalent to it or is a prerequisite for it.